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BEFORE THE
POSTAL REGULATORY COMMISSION
WASHINGTON, D.C. 20268–0001

PERIODIC REPORTING (PROPOSAL TWO)	Docket No. RM2022-8

RESPONSES OF THE UNITED STATES POSTAL SERVICE
TO QUESTIONS 1-6 OF CHAIRMAN'S INFORMATION REQUEST NO. 3
(August 10, 2022)

The United States Postal Service hereby provides its responses to the above listed questions of Chairman's Information Request No. 3, issued August 5, 2022. The questions are stated verbatim and followed by the response.

Respectfully submitted,

UNITED STATES POSTAL SERVICE

By its attorney:

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RESPONSE OF THE UNITED STATES POSTAL SERVICE TO CHAIRMAN'S INFORMATION REQUEST NO. 3

1. The Bradley Study provides equations for marginal cost and overall variability. Bradley Study at 12, 13. Please provide a thorough proof detailing the simplification process for the two above equations. In your response, please discuss in detail the steps of the simplification process and the underlying assumptions.

RESPONSE:

Page 12 of the Bradley Report states that the marginal cost with respect to the cost driver can be expressed in two ways:[1]

$$\frac{\partial \hat{C}_i}{\partial WSC_i} = (S_H - S_L)\left[\frac{\hat{\beta} e^{\hat{\alpha}+\hat{\beta} WSC_i}\left(1 + e^{\hat{\alpha}+\hat{\beta} WSC_i}\right) - \hat{\beta}\left(e^{\hat{\alpha}+\hat{\beta} WSC_i}\right)^2}{\left(1 + e^{\hat{\alpha}+\hat{\beta} WSC_i}\right)^2}\right].$$

$$\frac{\partial \hat{C}_i}{\partial WSC_i} = (S_H - S_L)\hat{\beta}\hat{p}[WSC_i](1 - \hat{p}[WSC_i])$$

Mathematically, this can be represented by the claim that:

$$(S_H - S_L)\left[\frac{\hat{\beta} e^{\hat{\alpha}+\hat{\beta} WSC_i}\left(1 + e^{\hat{\alpha}+\hat{\beta} WSC_i}\right) - \hat{\beta}\left(e^{\hat{\alpha}+\hat{\beta} WSC_i}\right)^2}{\left(1 + e^{\hat{\alpha}+\hat{\beta} WSC_i}\right)^2}\right]$$

$$= (S_H - S_L)\hat{\beta}\hat{p}[WSC_i](1 - \hat{p}[WSC_i]).$$

The division property of equality allows dividing both sides of the equation by $(S_H - S_L)$:

[1] *See*, Calculating Variabilities for Postmaster Costs, Docket No. RM2022-8, July 7, 2022 at 12.

$$\frac{(S_H - S_L)}{(S_H - S_L)}\left[\frac{\hat{\beta} e^{\hat{\alpha}+\hat{\beta} WSC_i}\left(1 + e^{\hat{\alpha}+\hat{\beta} WSC_i}\right) - \hat{\beta}\left(e^{\hat{\alpha}+\hat{\beta} WSC_i}\right)^2}{\left(1 + e^{\hat{\alpha}+\hat{\beta} WSC_i}\right)^2}\right]$$

$$= \frac{(S_H - S_L)}{(S_H - S_L)}\hat{\beta}\hat{p}[WSC_i](1 - \hat{p}[WSC_i]).$$

Next, use the fact that any non-zero number divided by itself is equal to one:

$$1 * \left[\frac{\hat{\beta} e^{\hat{\alpha}+\hat{\beta} WSC_i}\left(1 + e^{\hat{\alpha}+\hat{\beta} WSC_i}\right) - \hat{\beta}\left(e^{\hat{\alpha}+\hat{\beta} WSC_i}\right)^2}{\left(1 + e^{\hat{\alpha}+\hat{\beta} WSC_i}\right)^2}\right]$$

$$= 1 * \hat{\beta}\hat{p}[WSC_i](1 - \hat{p}[WSC_i]).$$

The identity property of multiplication permits dropping the one on both sides of the equation:

$$\left[\frac{\hat{\beta} e^{\hat{\alpha}+\hat{\beta} WSC_i}\left(1 + e^{\hat{\alpha}+\hat{\beta} WSC_i}\right) - \hat{\beta}\left(e^{\hat{\alpha}+\hat{\beta} WSC_i}\right)^2}{\left(1 + e^{\hat{\alpha}+\hat{\beta} WSC_i}\right)^2}\right]$$

$$= \hat{\beta}\hat{p}[WSC_i](1 - \hat{p}[WSC_i]).$$

The fact that:

$$\hat{p}[WSC_i] = \frac{e^{\hat{\alpha}+\hat{\beta} WSC_i}}{1 + e^{\hat{\alpha}+\hat{\beta} WSC_i}},$$

and the substitution property of equality permits elimination of $\hat{p}[WSC_i]$ from the right-hand-side of the equation:

$$\left[\frac{\hat{\beta}e^{\hat{\alpha}+\hat{\beta}WSC_i}\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)-\hat{\beta}\left(e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}\right]$$

$$=\ \hat{\beta}\,\frac{e^{\hat{\alpha}+\hat{\beta}WSC_i}}{1+e^{\hat{\alpha}+\hat{\beta}WSC_i}}\left(1-\frac{e^{\hat{\alpha}+\hat{\beta}WSC_i}}{1+e^{\hat{\alpha}+\hat{\beta}WSC_i}}\right).$$

The distributive property of multiplication permits expanding the right-hand-side of the equation:

$$\left[\frac{\hat{\beta}e^{\hat{\alpha}+\hat{\beta}WSC_i}\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)-\hat{\beta}\left(e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}\right]$$

$$=\ \hat{\beta}\,\frac{e^{\hat{\alpha}+\hat{\beta}WSC_i}}{1+e^{\hat{\alpha}+\hat{\beta}WSC_i}}-\hat{\beta}\,\frac{e^{\hat{\alpha}+\hat{\beta}WSC_i}}{1+e^{\hat{\alpha}+\hat{\beta}WSC_i}}\frac{e^{\hat{\alpha}+\hat{\beta}WSC_i}}{1+e^{\hat{\alpha}+\hat{\beta}WSC_i}}\,.$$

The definition of a square permits simplifying the right-hand-side of the equation:

$$\left[\frac{\hat{\beta}e^{\hat{\alpha}+\hat{\beta}WSC_i}\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)-\hat{\beta}\left(e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}\right]$$

$$=\ \hat{\beta}\,\frac{e^{\hat{\alpha}+\hat{\beta}WSC_i}}{1+e^{\hat{\alpha}+\hat{\beta}WSC_i}}-\hat{\beta}\,\frac{\left(e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}\,.$$

The subtraction property of fractions permits splitting the left-hand-side of the equation:

$$\frac{\hat{\beta}e^{\hat{\alpha}+\hat{\beta}WSC_i}\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}-\frac{\hat{\beta}\left(e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}$$

$$=\ \hat{\beta}\,\frac{e^{\hat{\alpha}+\hat{\beta}WSC_i}}{1+e^{\hat{\alpha}+\hat{\beta}WSC_i}}-\hat{\beta}\,\frac{\left(e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}\,.$$

The multiplication property of fractions permits rewriting the left-hand-side of the equation:

$$\frac{\hat{\beta}e^{\hat{\alpha}+\hat{\beta}WSC_i}}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)}\left(\frac{1+e^{\hat{\alpha}+\hat{\beta}WSC_i}}{1+e^{\hat{\alpha}+\hat{\beta}WSC_i}}\right)-\frac{\hat{\beta}\left(e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}$$

$$=\hat{\beta}\frac{e^{\hat{\alpha}+\hat{\beta}WSC_i}}{1+e^{\hat{\alpha}+\hat{\beta}WSC_i}}-\hat{\beta}\frac{\left(e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}.$$

Next, use the fact that any non-zero number divided by itself is equal to one:

$$\frac{\hat{\beta}e^{\hat{\alpha}+\hat{\beta}WSC_i}}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)}*1-\frac{\hat{\beta}\left(e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}$$

$$=\hat{\beta}\frac{e^{\hat{\alpha}+\hat{\beta}WSC_i}}{1+e^{\hat{\alpha}+\hat{\beta}WSC_i}}-\hat{\beta}\frac{\left(e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}.$$

The identity property permits dropping the one:

$$\frac{\hat{\beta}e^{\hat{\alpha}+\hat{\beta}WSC_i}}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)}-\frac{\hat{\beta}\left(e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}$$

$$=\hat{\beta}\frac{e^{\hat{\alpha}+\hat{\beta}WSC_i}}{1+e^{\hat{\alpha}+\hat{\beta}WSC_i}}-\hat{\beta}\frac{\left(e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}{\left(1+e^{\hat{\alpha}+\hat{\beta}WSC_i}\right)^2}.$$

Q.E.D.

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Page 13 of the Bradley report states that the overall variability with respect to WSCs can be expressed in two ways:[2]

$$\varepsilon_{\hat{C},WSC} = \left(\sum_{i=1}^{N} \frac{\partial \hat{C}_i}{\partial WSC_i} \frac{\partial WSC_i}{\partial WSC}\right) \frac{WSC}{\sum_{i=1}^{N} \hat{C}_i}.$$

$$\varepsilon_{\hat{C},WSC} = \sum_{i=1}^{N} \varepsilon_{\hat{C}_i,WSC_i}\, \varepsilon_{WSC_i,WSC}\, \frac{\hat{C}_i}{\sum_{i=1}^{N} \hat{C}_i}.$$

Mathematically, this can be represented by the claim that:

$$\left(\sum_{i=1}^{N} \frac{\partial \hat{C}_i}{\partial WSC_i} \frac{\partial WSC_i}{\partial WSC}\right) \frac{WSC}{\sum_{i=1}^{N} \hat{C}_i} = \sum_{i=1}^{N} \varepsilon_{\hat{C}_i,WSC_i}\, \varepsilon_{WSC_i,WSC}\, \frac{\hat{C}_i}{\sum_{i=1}^{N} \hat{C}_i}.$$

The identity property of multiplication permits multiplying the left-hand-side of the equation by one, twice:

$$\left(\sum_{i=1}^{N} \frac{\partial \hat{C}_i}{\partial WSC_i} * 1 \frac{\partial WSC_i}{\partial WSC} * 1\right) \frac{WSC}{\sum_{i=1}^{N} \hat{C}_i} = \sum_{i=1}^{N} \varepsilon_{\hat{C}_i,WSC_i}\, \varepsilon_{WSC_i,WSC}\, \frac{\hat{C}_i}{\sum_{i=1}^{N} \hat{C}_i}.$$

The fact that any non-zero number divided by itself is equal to one permits rewriting one in two ways:

$$1 = \frac{WSC_i}{WSC_i};\ \ 1 = \frac{\hat{C}_i}{\hat{C}_i}.$$

[2] *See*, Calculating Variabilities for Postmaster Costs, Docket No. RM2022-8, July 7, 2022 at 13.

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The substitution property of equality allows replacing the ones on the left-hand-side of the equation:

$$\left(\sum_{i=1}^{N}\frac{\partial \hat{C}_i}{\partial WSC_i}\frac{WSC_i}{WSC_i}\frac{\partial WSC_i}{\partial WSC}\ \frac{\hat{C}_i}{\hat{C}_i}\right)\frac{WSC}{\sum_{i=1}^{N}\hat{C}_i} = \sum_{i=1}^{N}\varepsilon_{\hat{C}_i,WSC_i}\,\varepsilon_{WSC_i,WSC}\ \frac{\hat{C}_i}{\sum_{i=1}^{N}\hat{C}_i}.$$

The multiplication property of fractions permits rewriting the left-hand-side of the equation:

$$\left(\sum_{i=1}^{N}\frac{\partial \hat{C}_i}{\partial WSC_i}\frac{WSC_i}{\hat{C}_i}\frac{\partial WSC_i}{\partial WSC}\ \frac{\hat{C}_i}{WSC_i}\right)\frac{WSC}{\sum_{i=1}^{N}\hat{C}_i} = \sum_{i=1}^{N}\varepsilon_{\hat{C}_i,WSC_i}\,\varepsilon_{WSC_i,WSC}\ \frac{\hat{C}_i}{\sum_{i=1}^{N}\hat{C}_i}.$$

Because both WSC and $\sum_{i=1}^{N}\hat{C}_i$ are constants with respect to the individual post offices, they can be brought into the summation:

$$\left(\sum_{i=1}^{N}\frac{\partial \hat{C}_i}{\partial WSC_i}\frac{WSC_i}{\hat{C}_i}\frac{\partial WSC_i}{\partial WSC}\ \frac{\hat{C}_i}{WSC_i}\frac{WSC}{\sum_{i=1}^{N}\hat{C}_i}\right) = \sum_{i=1}^{N}\varepsilon_{\hat{C}_i,WSC_i}\,\varepsilon_{WSC_i,WSC}\ \frac{\hat{C}_i}{\sum_{i=1}^{N}\hat{C}_i}.$$

The multiplication property of fractions permits rewriting the left-hand-side of the equation:

$$\left(\sum_{i=1}^{N}\frac{\partial \hat{C}_i}{\partial WSC_i}\frac{WSC_i}{\hat{C}_i}\frac{\partial WSC_i}{\partial WSC}\ \frac{WSC}{WSC_i}\frac{\hat{C}_i}{\sum_{i=1}^{N}\hat{C}_i}\right) = \sum_{i=1}^{N}\varepsilon_{\hat{C}_i,WSC_i}\,\varepsilon_{WSC_i,WSC}\ \frac{\hat{C}_i}{\sum_{i=1}^{N}\hat{C}_i}.$$

The definition of elasticity provides the formulas for $\varepsilon_{\hat{C}_i,WSC_i}$, $\varepsilon_{WSC_i,WSC}$:

$$\varepsilon_{\hat{C}_i,WSC_i} = \frac{\partial \hat{C}_i}{\partial WSC_i}\frac{WSC_i}{\hat{C}_i}.$$

$$\varepsilon_{WSC_i,WSC} = \frac{\partial WSC_i}{\partial WSC}\frac{WSC}{WSC_i}.$$

The substitution property of equality permits rewriting the left-hand-side of the equation:

$$\left(\sum_{i=1}^{N} \varepsilon_{\hat{C}_i,WSC_i}\, \varepsilon_{WSC_i,WSC}\ \frac{\hat{C}_i}{\sum_{i=1}^{N} \hat{C}_i}\right) = \sum_{i=1}^{N} \varepsilon_{\hat{C}_i,WSC_i}\, \varepsilon_{WSC_i,WSC}\ \frac{\hat{C}_i}{\sum_{i=1}^{N} \hat{C}_i}.$$

Q.E.D.

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2. The Bradley Study states that "the Postal Service will closely follow the explicit proposals the Commission put forth to resolve its concerns, without modifying those parts of Proposal Ten that were not of concern. For example, the Commission did not express any concerns about the operational database or the Postal Service's method of identifying a small number of out-of-bounds observations." Bradley Study at 4.

a. Please explain if and how the Postal Service can determine a measure of the degree of influence or extremeness for each of the identified outliers (*i.e.*, the out-of-bound observations) in Proposal Two. Please provide the methodology used and the assumptions made. If not possible to determine, please explain what is needed to quantify this measure.

b. Please explain the reason(s) (*e.g.*, causality, random events, etc.) for the presence of the reported outliers.

RESPONSE:

a. In the logit model context, identification of the influence of out-of-bounds observations can be made through the use of the Hosmer–Lemeshow (H-L) statistic. The H-L statistic ranks all the observations by their probability of being in a certain grade, forms them into groups, and then compares the actual number with the expected number, by group:

$$L = \sum_{q=1}^{10} \frac{\left(O_{rq} - E_{rq}\right)^2}{E_{rq}} + \sum_{q=1}^{10} \frac{\left(O_{nrq} - E_{nrq}\right)^2}{E_{nrq}}$$

In this equation, "O" stands for an observed value and "E" stands for an expected value. The H-L statistic is used to test the null hypothesis that the logit model has a good fit. If the H-L statistic indicates that the model has a poor fit, one can investigate the reason for the poor fit by examining those observations for which the WSC levels are out-of-bounds with respect to the post office's EAS grade:[3]

> An investigation into the source of these rejections demonstrated that the fit problem arises from a small number of observations that have WSCs very different from their grade and well beyond their respective Zones of Tolerance.
>
> For example, the upper bound for the EAS-20 grade is 13,000 WSCs and the upper Zone of Tolerance for the EAS-20 grade (between grade EAS-20 and grade EAS- 21) is between 13,001 WSCs and 14,299 WSCs. But there is an EAS-20 observation with 19,726 recorded WSCs.[6] The model would classify this office as a grade EAS-21, even though it is an EAS-20 grade in the data. Similarly, the lower bound for the EAS-21 grade is 13,001 WSCs and the lower Zone of Tolerance is between 11,701 WSCs and 13,000 WSCs. Yet there are two EAS-21 post offices with WSC values well below the lower Zone of Tolerance at WSC values of 683 and 4,609. The model would appropriately classify these two offices as EAS-20 grades despite being EAS-21 grades in the data. When these actual observations differ from their expectations, such circumstances cause the H-L statistic to indicate that the model has a poor fit.
>
> Potential influential observations can be identified by investigating the existence of post offices that are outside the Zone of Tolerance limits for their grade. To do this, a cutoff value is established for each Zone of Tolerance that is well beyond the extreme value for that Zone of Tolerance.

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[3] *See*, Investigating the Variability of Postmaster Costs, Docket No. RM2020-2, Nov. 29, 2019 at 26.

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For additional explanation of the methodology used to identify out-of-bounds offices, please see the response to Question 2 in Chairman's Information Request No. 2 in this docket.

b. The most likely reason for the existence of this very small number of out-of-bounds offices is data error.

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3. Please refer to Library Reference USPS-RM2022-8-1, filed July 7, 2022, folder "Directory 4 - Estimate 2022 Models and Variabilities," SAS program file "Identify Out of Bounds Obs.sas." Please also refer to the Bradley Study, which states: "Table 4 presents the boundary limits for the various Zones of Tolerance across the EAS grades, along with the cutoff value for identifying any out-of-bounds offices. It also presents the number of out-of-bounds offices identified for each model." Bradley Study at 18. Please explain why outliers were not evaluated for the EAS 24 to 26 logit model.

RESPONSE:

The calculation of the Hosmer–Lemeshow (H-L) statistic for the EAS-24 and the EAS-26 logit model, for both the 2019 and 2022 datasets, was consistent with good model fit. Because there was no problem with logit model fit, there was no need to investigate unduly influential observations. This result occurs for the EAS-24 and the EAS-26 logit model because there were no post offices outside the relevant Zones of Tolerance.

4. Please refer to Response to CHIR No. 1, question 1.a. – 1.b. The Postal Service states "[t]he development of attributable costs for Postmasters thus directly parallels the development of attributable costs for purchased highway transportation." Response to CHIR No. 1, question 1.a. – 1.b. The Postal Service further states that both methodologies consist of a "two-step process. One of the steps relates responses in cost to changes in a cost driver, and the other step relates responses in the cost driver to changes in volume." *Id.* Please confirm this parallelism is solely based on the two respective attributable cost methodologies consisting of the referenced two-step process. If confirmed, please explain the rationale behind this parallelism. If not confirmed, please elaborate on the rationale supporting the Postal Service's assertions.

RESPONSE:

Two costing processes are parallel if they are similar in form, function, and development. Below are the characteristics that demonstrate that the form, function, and development of attributable costs for Postmasters directly parallel the form, function, and development of attributable costs for purchased highway transportation.

Characteristic 1: The Use of a Cost Driver in Developing Attributable Costs

- Purchased highway transportation costing employs cubic foot-miles as a cost driver.
- Postmaster costing employs Work Service Credits as a cost driver.

Characteristic 2: The Overall Variability is the Product of Two Variabilities

- In purchased highway transportation costing, the overall variability is the product of the variability of cost with respect to cubic foot-miles and the variability of cubic foot-miles with respect to volume.

- In Postmaster costing, the overall variability is the product of the variability of cost with respect to Work Service Credits and the variability of Work Service Credits with respect to volume.

Characteristic 3: The Cost-to-Cost Driver Variability Was the First One Estimated

- In purchased highway transportation costing, the initial variability to be estimated was the variability of cost with respect to cubic foot-miles.
- In Postmaster costing, the initial variability to be estimated was the variability of cost with respect to Work Service Credits.

Characteristic 4: The Driver-to-Volume Variability was Assumed to be Proportional While Research on the Cost-to-Cost Driver Variability Proceeded

- In purchased highway transportation costing, the assumption of proportionality between cubic foot-miles and volume was maintained as research on the cost-to-cubic foot-miles variability was pursued in Docket No. R84-1, in Docket No. R87-1, in Docket No. R97-1, in Docket No. R2000-1, and in Docket No. RM2014-6.
- In Postmaster costing the assumption of proportionality between Work Service Credits and volume was maintained as research on the cost-to-Work Service Credit variability was pursued in Docket No. R84-1, in Docket No. RM2020-2, and in Docket No. RM2022-8.

5. Please refer to the Bradley Study that states: "[i]n many parts of the established attributable costing methodology, such as mail processing or carrier delivery, the linkage of the cost driver to volume is based upon the assumption of proportionality. That is also the case for Postmasters, as the established methodology assumes that changes in [Work Service Credits (WSCs)] are proportional to changes in volume." Bradley Study at 33. Please also refer to Response to CHIR No. 1, question 1.a. – 1.b. that states: "the Postal Service decided to follow the approach taken in purchased highway transportation, in which the variability between costs and the cost driver was updated and refined, while research on the feasibility of updating the variability between the cost driver and volume proceeded. This decision is further justified by the fact … that a reduction in the assumed WSC-to-volume variability is unlikely to have a large impact on attributable Postmaster costs per piece." Response to CHIR No. 1, question 1.a. – 1.b.

a. Please confirm that the assumed proportionality between changes in WSCs and changes in volume discussed in the Bradley Report is one-to-one.

b. If subpart a. is confirmed, please explain the basis for this assumption.

c. If subpart a. is not confirmed, please provide the assumed proportionality between changes in WSCs and changes in volume along with an explanation for this assumption.

d. Please confirm that the assumed WSC-to-volume variability discussed in Response to CHIR No.1 can exceed 100 percent.

e. If subpart d. is confirmed, please

i. explain the rationale behind making inferences from a reduction in WSC-to-volume variability but not making such an inference from an increase in WSC-to-volume variability.

ii. provide a justification for the decision quoted in Response to CHIR No. 1in terms of the expected impact of an increase in WSC-to-volume variability.

RESPONSE:

a. Confirmed.

b. The basis for the application of the proportionality assumption in Proposal Two is the fact that it has been part of the established methodology, approved by the Commission, for over thirty-five years. Proposal Two simply maintains this ongoing assumption. The Postal Service could not locate any historical documentation for the application of the proportionality assumption to this cost segment, but the proportionality assumption has long been used by the Commission in its established attributable costing methodology. For example, the assumption was discussed and explained in an academic paper in 1999:[4]

> The proportionality between the driver and volume for a given mail product is, in principle, a testable proposition and one that is plausible in many cost components. The assumption means, for example, that at a point in time, the last piece of First Class mail entered into the highway transportation system requires the same amount of truck capacity as do all the previously entered First Class pieces. Similarly, the homogeneity assumption on the driver relation means that the number of mail processing piece handlings per First Class piece does not change as First Class volume increases. In other words, the cost-causing characteristics of the product do not change as volume increases.

c. Not applicable.

d. Not confirmed. Although the question does not request an explanation for why the variability of WSCs with respect to volume cannot exceed one hundred percent, the

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[4] *See*, Bradley, Michael D., Colvin, Jeff, and Panzar, John C., "On Setting Prices and Testing Cross-Subsidy with Accounting Data," *Journal of Regulatory Economics*, Vol. 16, No.1, July 1999 at 83.

Postal Service will gladly provide it. As discussed in Question 1 of Chairman's Information Request No. 1, there are a number of factors that determine Work Service Credits that are not volume related, and these non-volume factors are material:[5]

> Please confirm that inputs to the WSC calculation that appear to be non-volume variable (*e.g.*, delivery points) significantly influence the WSC calculation.

and:[6]

> Explain if the influence of non-volume-variable factors in the WSC calculation would suggest that WSCs do not vary fully proportionally with volume

These non-volume factors include measures such as the total possible city deliveries, the number of post office boxes served, or the number of general delivery families served. Moreover, as the response to Q1 discusses, these non-volume factors have a multiplicative relationship with regard to WSCs.

For example, a post office gets a credit of "1" for each post office box served and a credit of "1.33" for each possible city delivery. The calculation of the non-volume-determined WSCs can be described by the following equation, in which the non-volume factors are represented by the NV_i and their weights are represented by δ_i:

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[5] *See*, Chairman's Information Request No. 1, Docket No. RM2022-8, July 15, 2020 at Question 1.

[6] *Id.*

$$WSC_{NV} = \sum_i^n \delta_i NV_i.$$

For the purpose of this investigation of the role of volume-related WSCs in determining the overall WSC-to-volume variability, the relationship between WSCs and volume will be kept perfectly general:

$$WSC_V = \theta(V).$$

Total WSCs are the sum of those that are volume related and those that are non-volume related:

$$WSC = WSC_V + WSC_{NV} = \theta(V) + \sum_i^n \delta_i NV_i.$$

The volume-to-WSC variability is obtained by applying the elasticity formula to this equation:

$$\varepsilon_V = \frac{\theta'(V)V}{\theta(V) + \sum_i^n \delta_i NV_i}.$$

For the volume-to-WSC variability to exceed one hundred percent, it must be the case that:

$$\varepsilon_V = \frac{\theta'(V)V}{\theta(V) + \sum_i^n \delta_i NV_i} > 1.$$

This, in turn, requires:

$$\theta'(V)V > \theta(V) + \sum_i^n \delta_i NV_i.$$

Dividing through by $\theta(V)$ yields:

$$\frac{\theta'(V)V}{\theta(V)} > 1 + \frac{\sum_i^n \delta_i NV_i}{\theta(V)}.$$

The left-hand-side of this equation is the variability of the volume-related WSCs with respect to volume. On the right-hand-side of the equation, the non-volume determined WSCs are all positive, so for the overall volume-to-WSC variability to be greater than one, it must be the case that the variability of the volume-related WSCs with respect to volume must be (substantially) larger than one.[7] In other words, volume-related WSCs must increase faster than volume. But given the structure of volume-related WSC determination, this outcome cannot occur.

To see why this is the case, recall that determination of an office's volume-related WSCs works though the impact of each post office's revenue units. To the extent an office's revenue rises as its volume rises, it will have more revenue units. And more revenue units will imply more WSCs. But the relationship between WSCs and revenue units specifies that the increase in WSCs in response to additional revenue units is decreasing in the number of revenue units. In other words, as the number of revenue units rise, the rate of increase in WSCs falls. Such a relationship between

[7] To the extent that the non-volume factors determine a large proportion of WSCs, this condition will require the variability of the volume-related WSCs with respect to volume to be much larger than one. For example, if the non-volume-related WSCs equaled the volume related WSCs, then this condition would require the variability of the volume-related WSCs with respect to volume to be 200 percent.

WSCs and revenue units restricts the variability of the volume-related WSCs with respect to volume to be less than 100 percent, and thus precludes it from being over 100 percent. When this specification is combined with the structure of non-volume-related WSCs, the result is that the overall variability must be less than 100 percent.

REVEUE CREDIT STRUCTURE

Revenue Unit Range	Revenue Credit Formula
0-25	RU
26-300	25+0.5*(RU-25)
301-1,000	162.50+.25*(RU-300)
1,001-6,000	337.50+.10*(RU-1,000)
6001 & Up	837.50+.01*(RU-6,000)

e. Not applicable.

RESPONSE OF THE UNITED STATES POSTAL SERVICE TO CHAIRMAN'S INFORMATION REQUEST NO. 3

6. Please refer to Library Reference USPS-RM2022-8-1, filed July 7, 2022, folder "Directory 1 – MEDBPAC 2019", SAS log file "2019 Calculate Variability 24 and 26.txt," and folder "Directory 3 – Compare Datasets," SAS log file "Compare 2022 and 2019 Datasets.txt."

a. Please confirm that the number of observations used to estimate the 2019 variabilities appears to be different when comparing the Directory 1 programs to the Directory 3 program for all EAS Grade pairs except for EAS-24 to EAS-26.

b. If subpart a. is confirmed, please explain the reasons for this discrepancy.

c. If subpart a. is not confirmed, please provide the number of observations used to estimate the 2019 variabilities in the Directory 1 programs and the Directory 3 program.

RESPONSE:

a. Confirmed that the sum of the number of observations used to estimate the logit models in Directory 1 is different than the number of observations used in the comparative analysis in Directory 3. Please note, however, that the size of the initial dataset read into the Directory 1 programs (13,611 observations) matches the number of observations (13,611) in the 2019 dataset used in the program in Directory 3.

b. Estimation of the logit models, except for the model for the EAS-24 and EAS-26 pair, required elimination of a small number of observations. Thus, the sum of the number of observations used to estimate the logit models is slightly smaller than the number of observations in the original 2019 dataset. The program in Directory 3 is designed to compare the original dataset from 2022 with the original dataset from 2019. The 2019 dataset thus contains all observations.